Supplementary Material

Perspectives of Polymers in Forensic Analysis

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A chemical sensor is defined by the IUPAC as "device that converts chemical data, ranging from the concentration of a single sample component to complete composition analysis, into an analytically usable signal". It is composed of 2 units: a receptor and a transducer. There are many types of receptors, ranging from activated or doped surfaces to complex (macro)molecules that create highly specific interactions with the analyte (Figure S1). If the receptor is of biological origin (e.g., DNA, antibodies, and enzymes), the sensor is known as a biosensor.

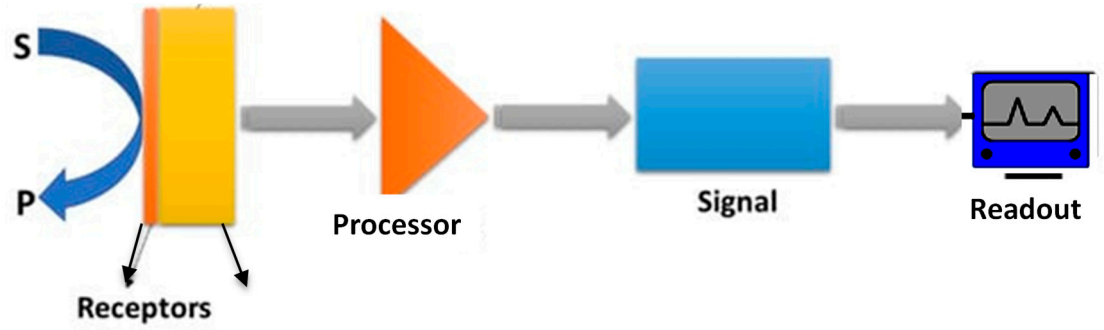

Figure S1. Schematic representation of a chemical sensor and its main components.

Electrochemical sensors are a kind of chemical sensors in which the transducer is an electrode. They consist of two or three electrodes (counter and/or reference and working) surrounded by selective membranes that separate an internal reference ionic solution surrounding the electrodes from the external analyte solution (Figure S2). This sets up an electrical potential between the two ionic solutions that can be measured. In the measurement process there is an electrochemical reaction that results in a change in current, potential or conductivity, which are named as amperometric, potentiometric and conductometric sensors [1].

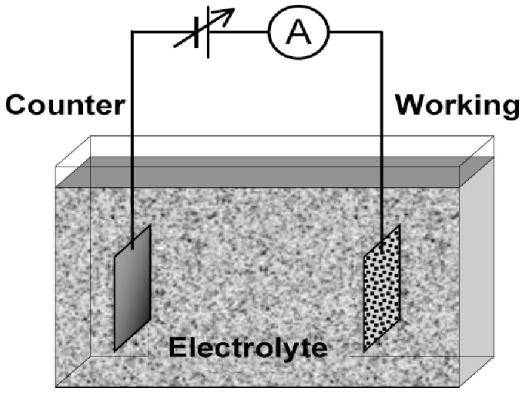

Figure S2. Schematic representation of an amperometric sensor with two electrodes.

In these sensors, the sensitivity and selectivity toward the target analyte are very important parameters. Cyclic Voltammetry (CV) is a type of electro-analytical method, in which information about the analyte is obtained by varying a potential and then measuring the resulting current. It is an amperometric technique.

Piezoelectric sensors are devices that use the piezoelectric effect to measure changes in pressure, acceleration, temperature, strain, etc. (Figure S3). They employ piezoelectric materials (PZT) that resonate under the application of an external alternating electrical field. Usually, quartz crystals are used, producing an oscillating electric field in which the resonant frequency of the crystal depends on its chemical nature, size, shape, and mass [15]. The mass changes that take place after the interaction with the analyte can be measured by means of piezoelectric transducers, such as quartz crystal microbalances (QCM) and microcantilevers

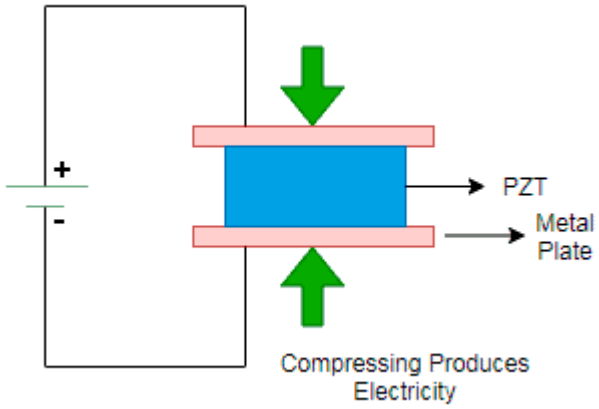

Figure S3. Schematic representation of an piezoelectric sensor.

Fluorescence sensors are based on the the emission of light by a substance that has absorbed light or other electromagnetic radiation. Generally, the emitted light has a longer wavelength, and therefore a lower frequency, than the absorbed radiation. These sensors are typically based on the quenching effect, that is, the diminution or attenuation of the fluorescence of a compound in the presence of other compound named as "quencher". Fluorescent molecules have groups called fluorophores. There are two main types of quenching (Figure S4): Collisional or dynamic quenching occurs when the excited-state fluorophore is deactivated upon contact with the quencher, resulting in charge or energy transfer. This change is known as dynamic quenching, in which the excited-state lifetime of a fluorophore decreases with increasing quencher concentration irrespective of the spectral profile of the fluorophore. Fluorescent materials can form non-fluorescent complexes with quenchers, which is known as static quenching. The interaction between the quencher and fluorophore occurs in the ground state. Upon irradiation with light, the system returns to the ground state without emission. The static quenching mechanism is recognized by changes in the absorption spectra of the fluorophore, independence from the excited-state lifetime of the fluorophore, and an increase in the emitted intensity upon increasing temperature.

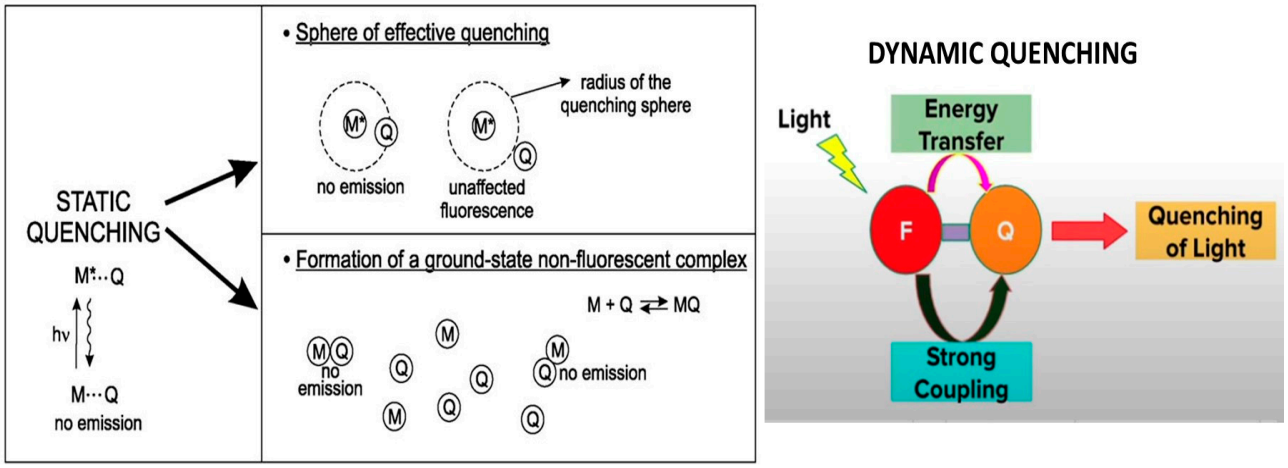

Figure S4. Schematic representation of static and dynamic quenching processes.